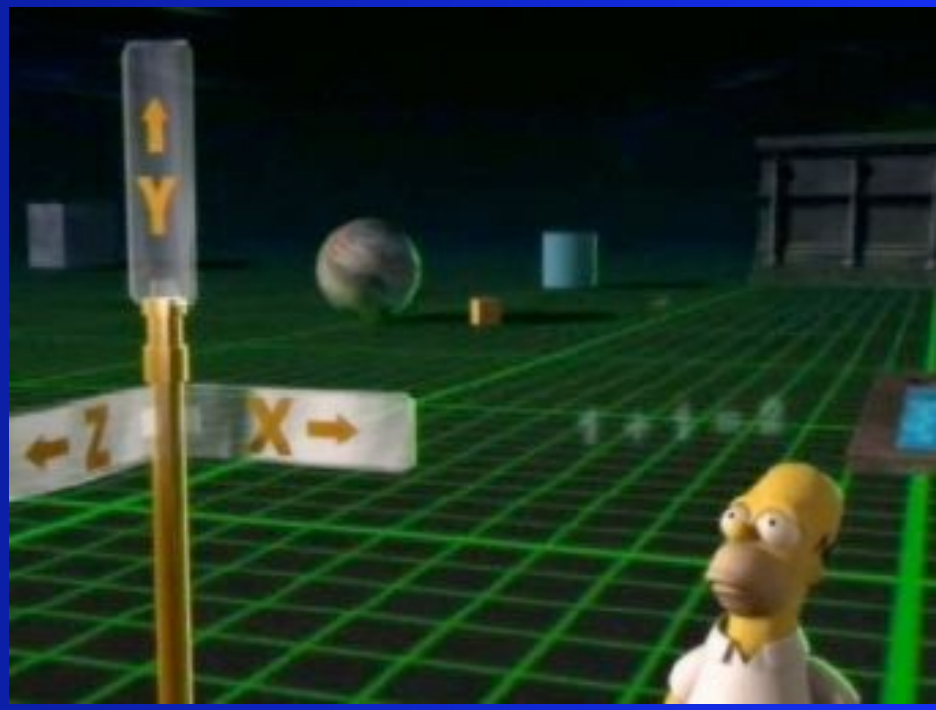
Welcome to Physics 1C!

Waves, Optics, and Modern Physics

102 Peterson Hall, MTuWTh 9:30-10:50



Who am I?

- Ramin Skibba

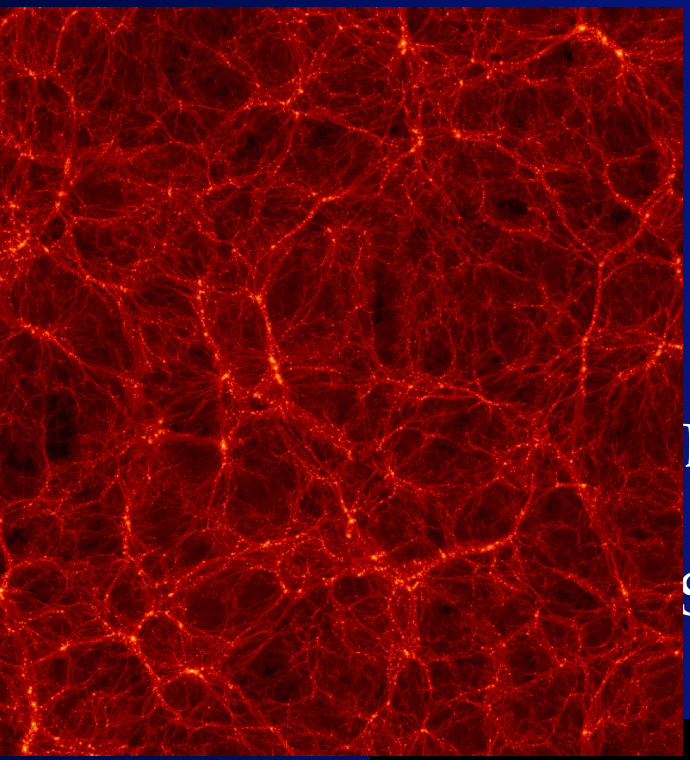
  rskibba@ucsd.edu, 429 SERF building

- I work in astrophysics, especially involving galaxy formation, dark matter, and cosmology
- My interests also include science policy and science communication

- TA: Raul Herrera, leads PBs on Wednesdays at 11-12:50 at Center Hall 222

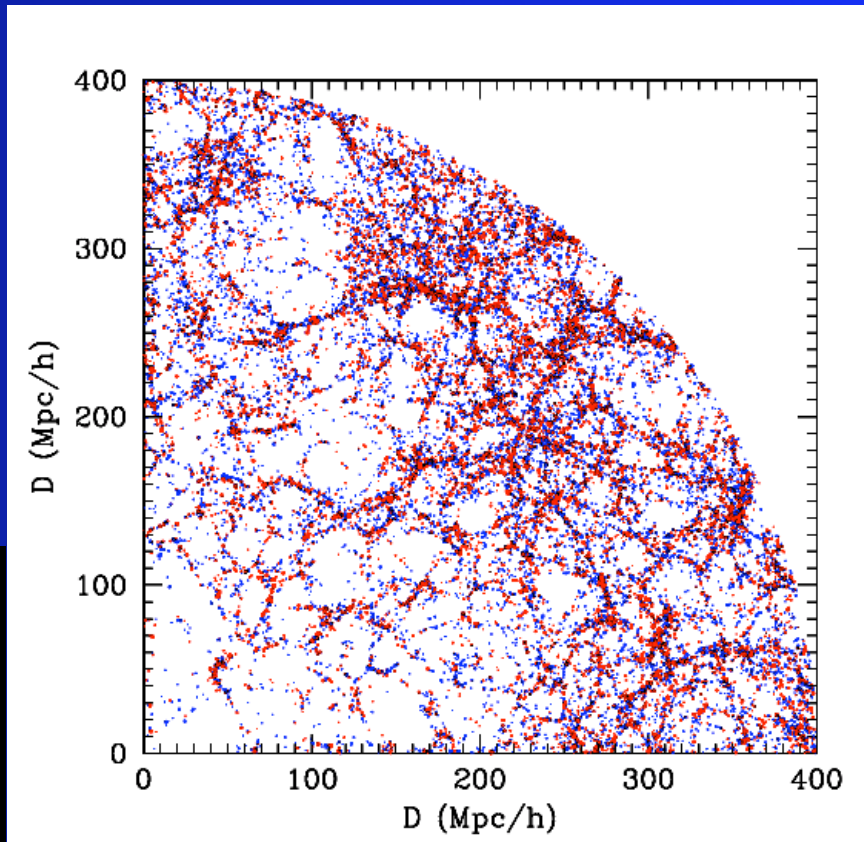
  rherrera@physics.ucsd.edu

Large-scale structure of Galaxies & Dark Matter



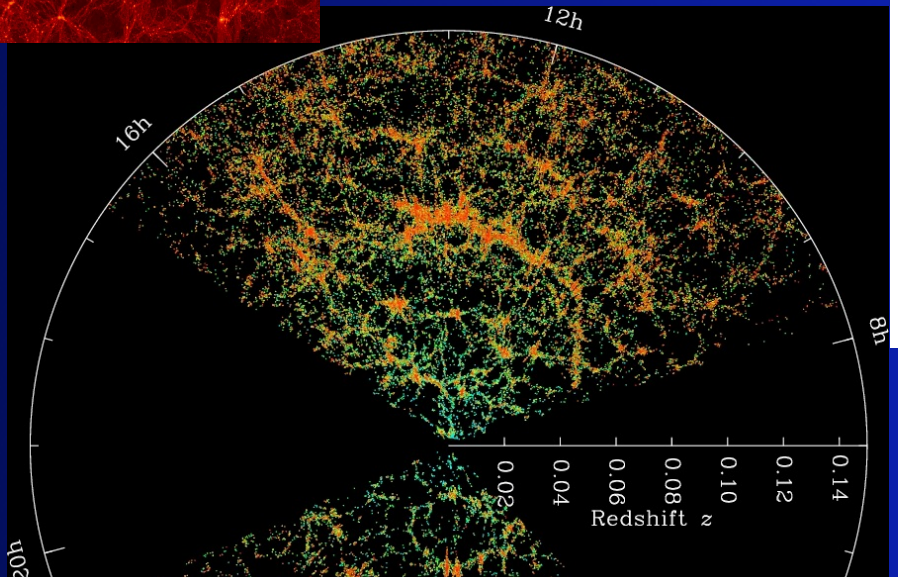
DM haloes
in Bolshoi
Simulation

galaxies in my model



Skibba et al. (2013)

galaxies in
Sloan Digital
Sky Survey



Going beyond lectures...

The more you're engaged and think critically, the more you'll learn.

"The lecture method is the process whereby the lecture notes of the instructor get transferred to the notebooks of the students without passing through the brains of either!"

-- Darrell Huff

The Montillation of Traxoline

It is very important that you learn about traxoline. Traxoline is a new form of zionter. It is montilled in Ceristanna. The Ceristannians gristerlate large amounts of fevon and then brachter it to quasel traxoline. Traxoline may well be one of our most lukized snezlaus in the future because of our zionter lescelidge.

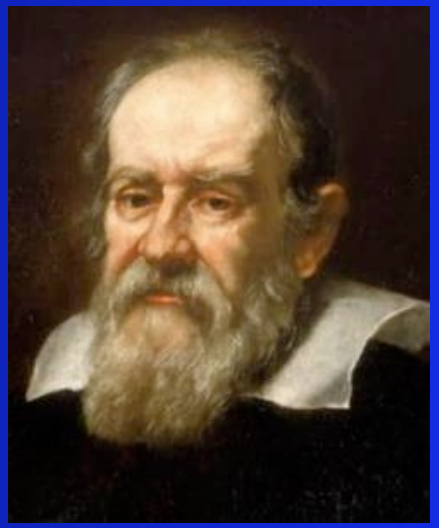
Directions: Answer the following questions in complete sentences. Be sure to use your best handwriting.

- What is traxoline?
- Where is traxoline montilled?
- How is traxoline quaselled?
- Why is it important to know about traxoline?

some words of inspiration

"You cannot teach a man anything; you can only help him to find it within himself."

- Galileo Galilei



"Nothing in life is to be feared, it is only to be understood. Now is the time to understand more, so that we may fear less."

- Marie Curie

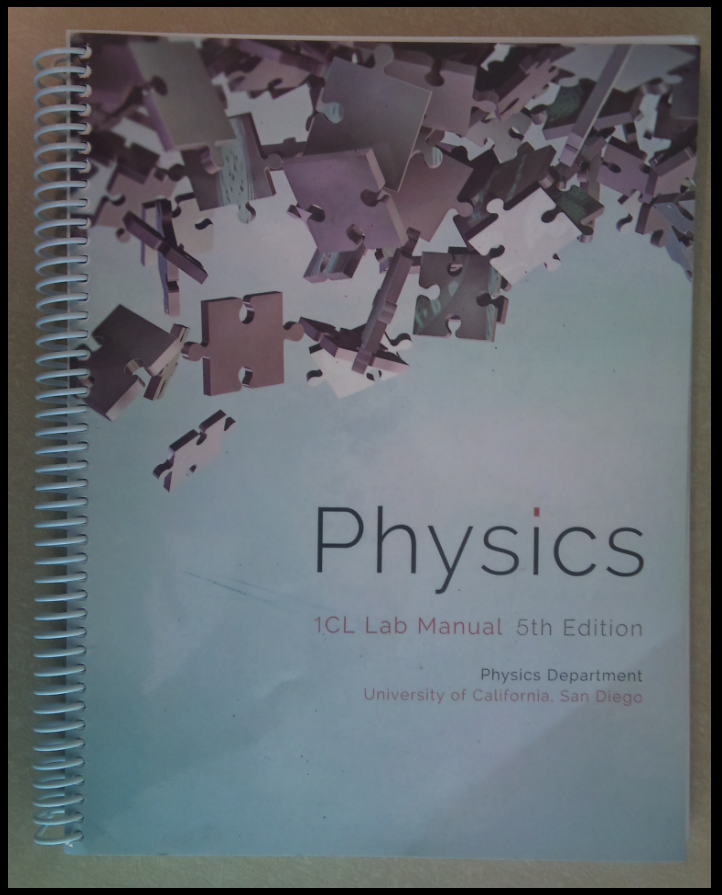
Physics 1CL

Lab TA Coordinators

- **Mike Eldridge** (meldridge@ucsd.edu)
- **Sebastian Diaz** (s1diaz@ucsd.edu)
- **Prarit Agarwal** (pagarwal@ucsd.edu)

Faculty Instructor

- **Ian Schanning**



Lab Manual (5th Edition) is available at the bookstore.

Syllabus/Calendar Link/Supplementary Materials on TED.

Labs start ***this*** week!

- Lab classes start on the ***1st week*** of classes (this week!).
- The 1st week will be a general review of Phys 1CL and of the safety rules.
- No preparation is required for the first lab class and it will not be graded.
- Lab 1 will take place on the 2nd week of classes (next week).
- The attendance of the lab classes on the 1st and 2nd week is ***mandatory***. You will not be able to take Phys 1CL if you miss it on either 1st or 2nd week.

The labs are located in 2306 and 2326 Mayer Hall!

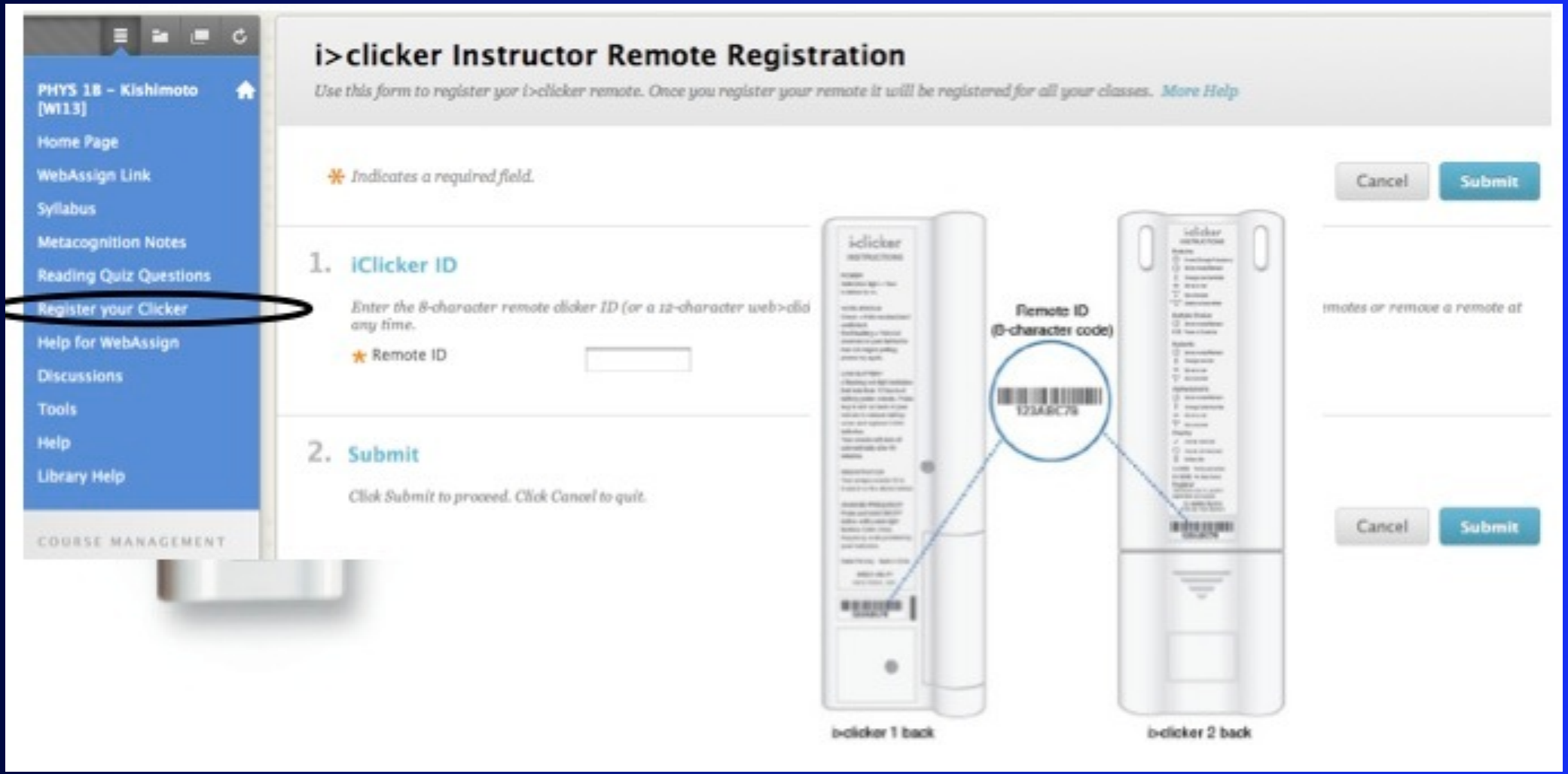
Attendance in labs are mandatory for the first two lab meetings starting from ***week one***!

You are to bring the Academic Integrity Policy to the first day of lab.

The reading quiz given on the second lab meeting will be partially based on the Academic Integrity Policy and the Scientific Integrity Primer!

Learner-Centered Components of the Course

1. clickers



Knowledge-Centered Components of the Course

1. **clickers**
2. **textbook**
   - weekly reading quizzes
   - suggested homework
3. **extra credit:** writing about physics applications

Assessment-Centered Components of the Course

1. clickers
2. textbook
   - weekly reading quizzes
   - suggested homework
3. extra credit: writing about physics apps
4. **weekly homework problems**
5. **weekly quizzes**

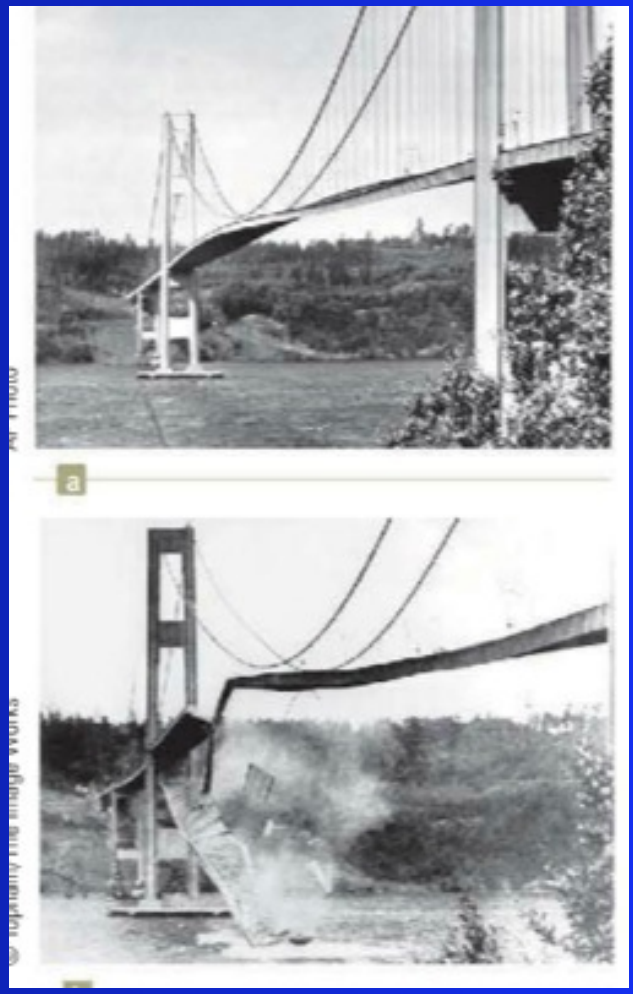
WebAssign

You should have access to WebAssign with your textbook. If not, you're given free access through the duration of the course. First self-enroll on webassign.net with the class key: ucsd 1146 4985

Homework problems and reading quizzes will be assigned there, and they are due twice a week: on ***Wednesday at 9:30am*** and on ***Friday at 5pm***

We will have assignments every week, but this Wednesday's assignment won't be graded.

http://www.webassign.net



Components of the Course

schedule of weekly quizzes and final exam…

Four quizzes, every week on Mondays during first half of class:

- July 6th
- July 13th
- July 20th
- July 27th

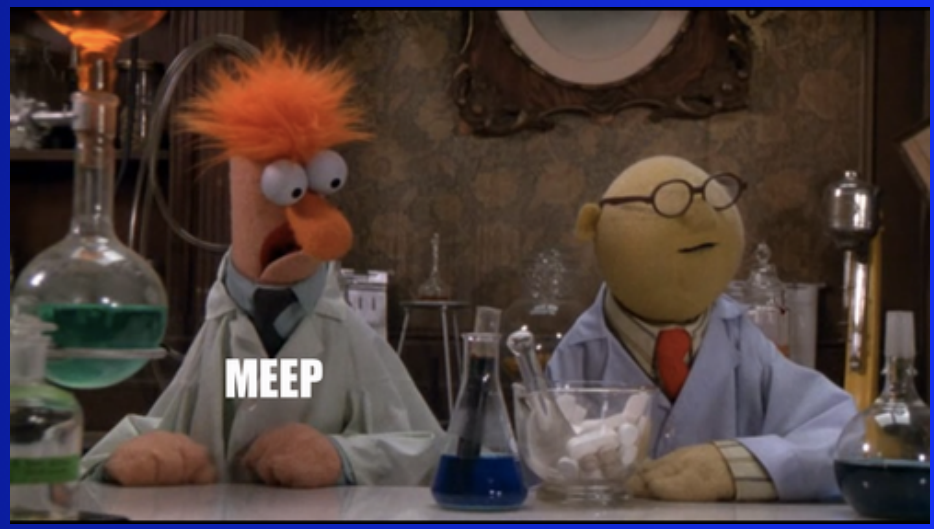
Comprehensive **Final Exam** on Friday, July 31st

Components of the Course

Grading Scheme

- **Class participation** (10%)
  - clickers (1/3)
  - homework problems & reading quizzes (2/3)
- **Weekly quizzes** (60%)
- **Final exam** (30%)
- **Extra credit** (0-5%)

Final grades will be slightly curved, but there will be some B's and C's.



Components of the Course

Physics we'll explore this summer:

- **Oscillatory Motion** (chapter 12)
- **Mechanical Waves** (ch. 13)
- **Superposition and Standing Waves** (ch. 14)
- **Wave Optics** (ch. 27)
- **Reflection and Refraction of Light** (ch. 25)
- **Image Formation by Mirrors and Lenses** (ch. 26)
- **Quantum Physics** (ch. 28)
- **Atomic Physics** (ch. 29)
- **Nuclear Physics** (ch. 30)
- **Particle Physics** (ch. 31), time-permitting

Components of the Course

We will also discuss:

- **the history, philosophy, and sociology of physics**
- **the workings of the scientific process**
- **connections between physics and other fields, especially biology and chemistry**
- **new relevant physics discoveries scientists have made**
- **important applications of the physics concepts**

Components of the Course

Extra credit:

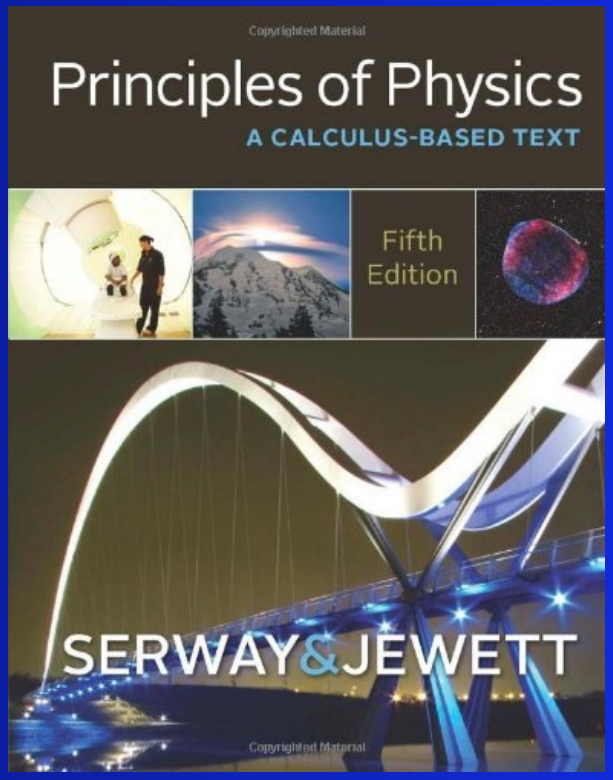
- By the last class you may turn in one extra credit assignment consisting of a statement or short paper
- This assignment can be about physics applications, discoveries, or news related to material we've covered throughout the course
- examples: telescopes or microscopes with mirrors, fusion energy research, medical devices utilizing lasers, carbon dating, LED lights, quantum computing, etc.
- It should be about 3-4 double-spaced pages in length. Make sure to cite your sources.

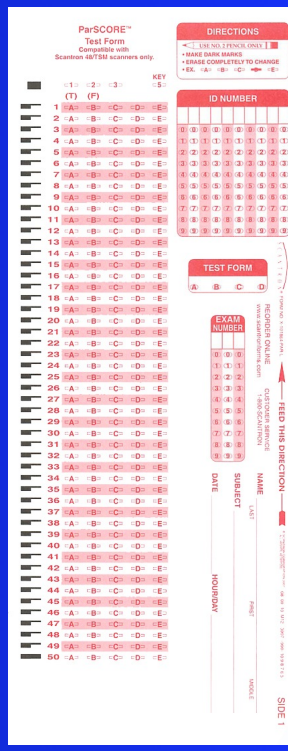
physics is everywhere!

- this year is the International Year of Light
- the recent Nobel Prize in Physics was for blue LED technology
- scientists published new research on quantum mechanics, atomic physics, and optics this year
- the feasibility and politics of fusion energy (nuclear physics) have been in the news
- 2015 is also the 100th anniversary of Einstein's theory of relativity
- and 2015 is the 25th anniversary of the Hubble Space Telescope

What will you need?
(other than your brain and your motivation)

- **textbook:** Serway & Jewitt, *Principles of Physics*, 5th ed.
- **i>clicker remote**
- **scientific calculator**
- 5 **scantrons**, form X101864-PAR
- **No. 2 pencils** to fill in scantrons
- FREE WebAssign account





WebAssign®

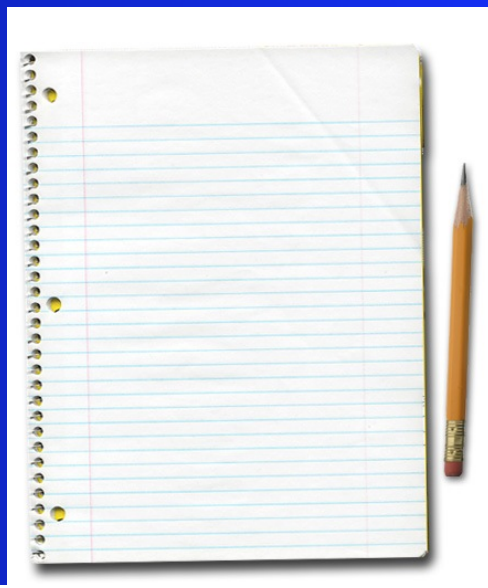
Laptops and tablets will not be allowed in lecture.

Please turn off cell phones before class.

Be prepared to focus and participate during class. Some classes will include a short break in the middle.

A calculator should be brought to class every day.

On exam days, you may not use a device that can communicate with anyone else who also has calculator capabilities.



How do I excel in this course?

- Work smart
- Learn the material!
- Come to class and actively participate in class discussions. Be prepared for class.
- Remember that the material is challenging and each class builds on the previous one.
- Keep up! Don't fall behind.
- Practice makes perfect, as they say. Do your homework.
- Get help ASAP if you are confused. That's what we're here for!

clicker question

What is the course TA's name?

A. Jacques

B. Robin

C. Ravi

D. Raul

E. Karl

clicker question

Each week, when will the first homework problems and reading quizzes be due? At the beginning of class on:

A. Monday

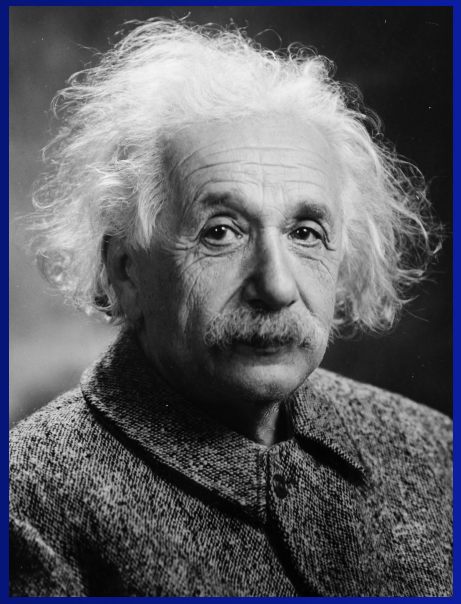
B. Tuesday

C. Wednesday

D. Thursday

E. Friday

cast of characters



Marie Curie, Albert Einstein, Max Planck, Maria Goeppert-Mayer, Louis de Broglie…

physics is phun!

1. **What do you most look forward to learning about in this course?**

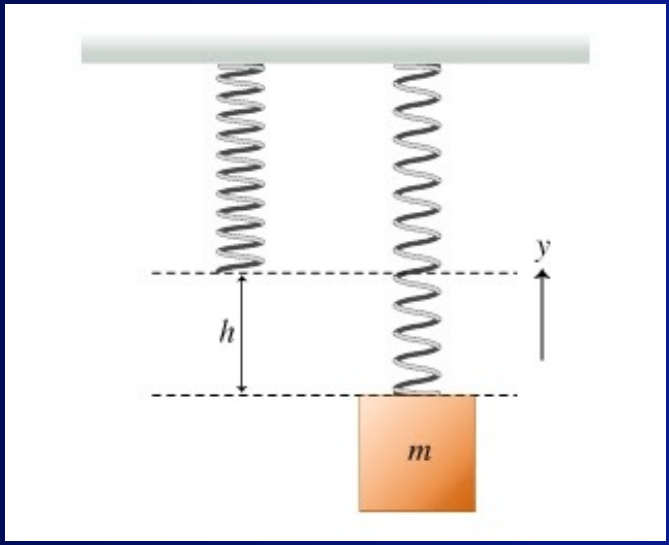
2. **In which field of physics do you think research and development have had the biggest impact on modern society?**

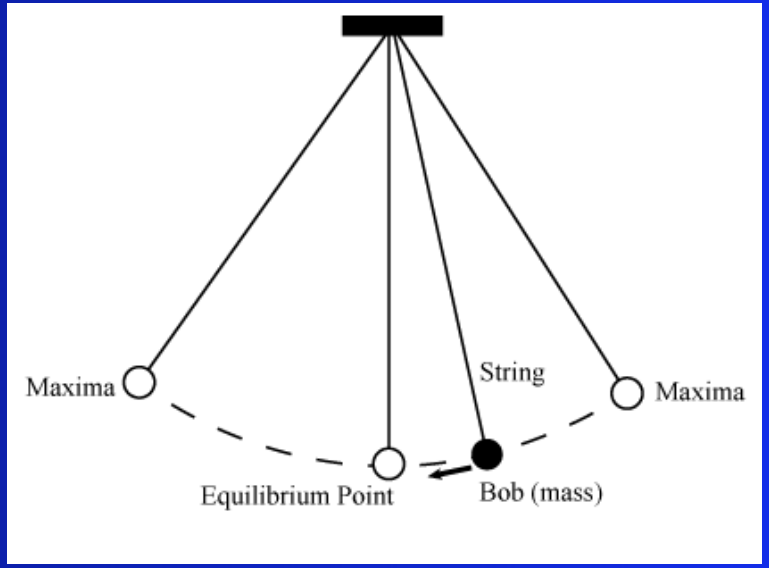
- **mechanical waves (oscillatory motion, sound waves, seismic waves, etc.)**
- **wave optics (lasers, holography, X-rays, lenses and mirrors, etc.)**
- **quantum physics (semiconductors, transistors, electron microscope, etc.)**
- **atomic and nuclear physics (radioactivity, fission, fusion, etc.)**

Next steps:

1. get the syllabus (and these slides) from
   `http://cass.ucsd.edu/~rskibba/work/Teaching.html`
2. ***review the syllabus*** and the math problems on the last page
3. make sure that you can log in to WebAssign (ucsd 1146 4985):
   `http://www.webassign.net`
4. read Chapter 12 (especially sections 12.1-12.4)

Part II: Simple Harmonic Motion





Reminders

- course website: `http://ted.ucsd.edu`
- backup course website, where the syllabus is already available: `http://cass.ucsd.edu/~rskibba/work/Teaching.html`
- `http://www.webassign.net`

  self-enroll with our 1C class key: `ucsd 1146 4985`

This week's homework problems/questions for chapter 12:
Obj.Q. #1, 7, 11, 12; Conc.Q. #1 & 4; Problems #1, 3, 17, 20 & 33

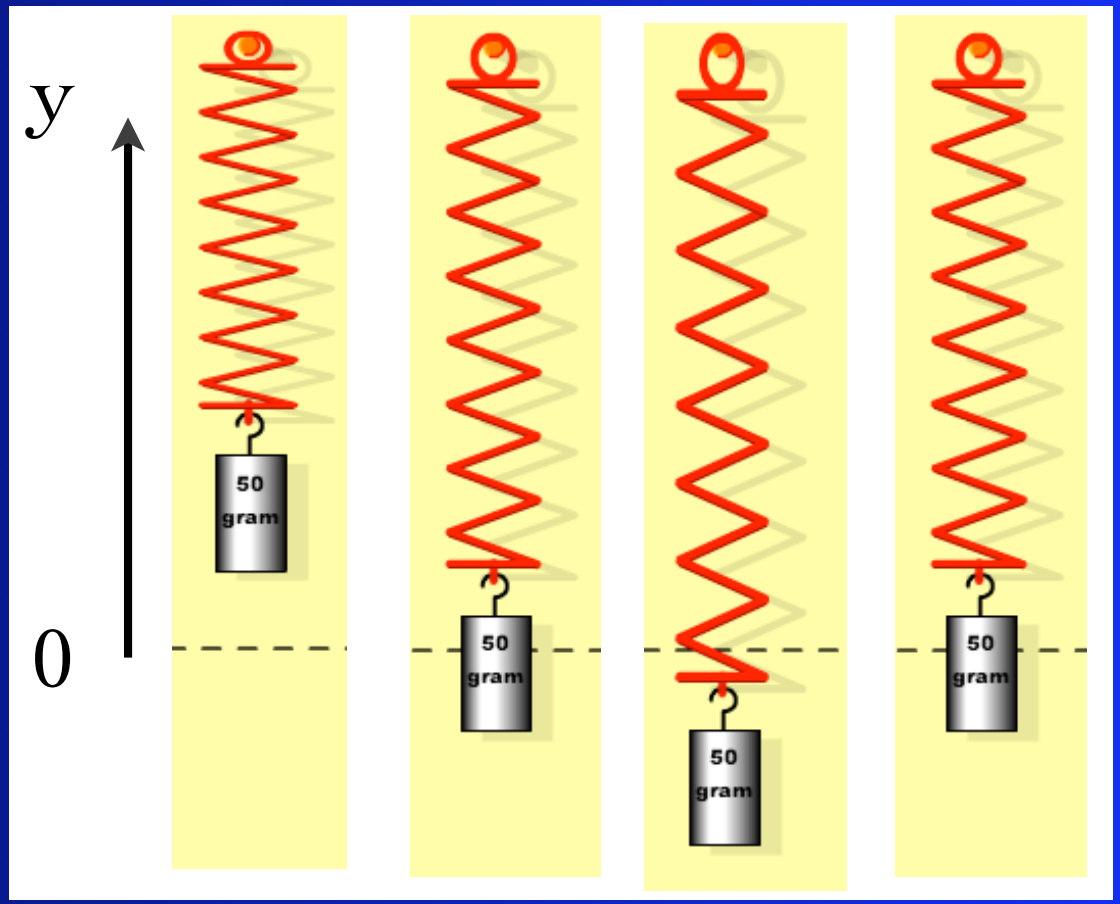
There are "suggested problems" as well, and I strongly recommend you work on them. The chapter 12 homework will not be due for a grade, but the next assignment (for ch. 13, due on Friday) will be graded.

Oscillatory Motion

- Hooke's law: $F = -kx$
- and remember Newton's second law: $F = ma$
- a point mass on a spring exhibits "simple harmonic motion"
- a simple pendulum at small angles approximately does too
- for a mass on a spring, the position as a function of time can be modeled as $x(t) = A\cos(\omega t+\phi)$, where A, ω, and ϕ are the amplitude, frequency, and phase, respectively
- Note how position, velocity, acceleration, and periods of masses on springs and pendular are similar

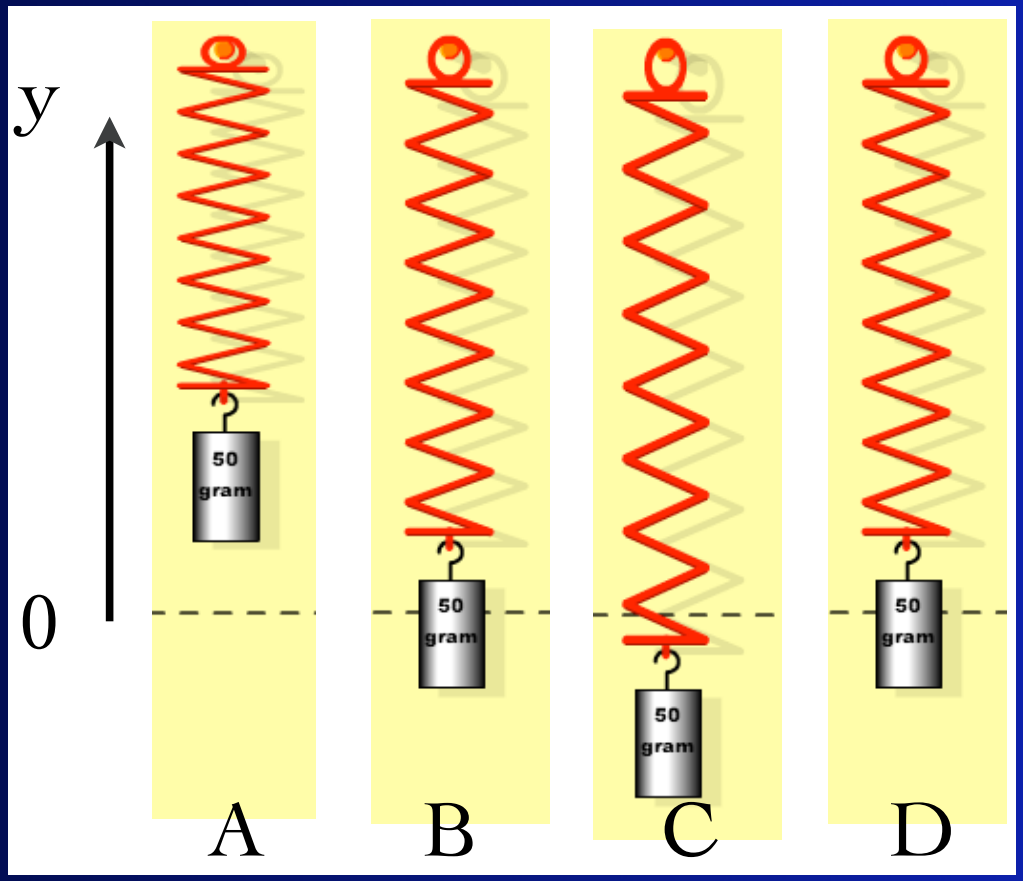
Mass on a Spring

Sketch the motion of the mass. When is the position positive/negative? When is the velocity positive/negative? When is the acceleration positive/negative? [Recall that $v=\mathrm{d}x/\mathrm{d}t$ and $a=\mathrm{d}v/\mathrm{d}t$.]



Mass on a Spring: velocity

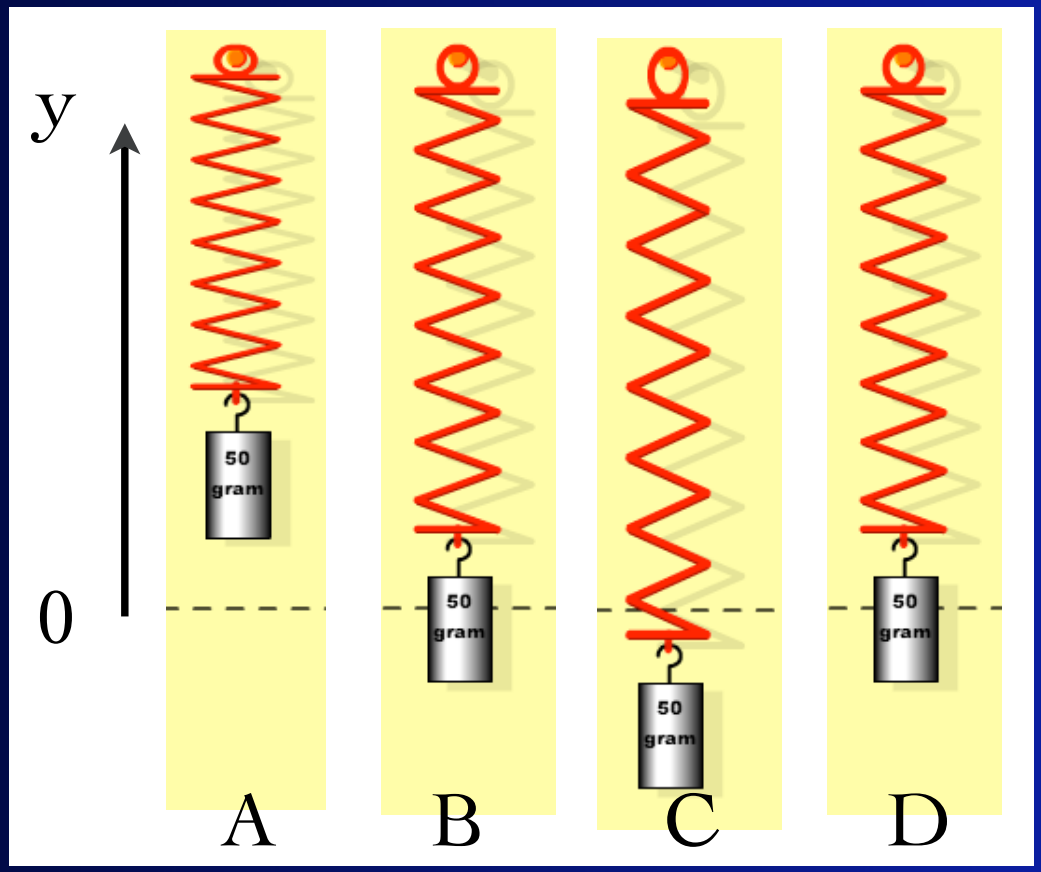
Points A & C represent the highest and lowest points of the motion, respectively. Choices A-D show sequential moments in the oscillation of the mass shown. At which point(s) is the mass's velocity positive?



E. More than one of these choices have a positive velocity

Mass on a Spring: acceleration

Points A & C represent the highest and lowest points of the motion, respectively. Choices A-D show sequential moments in the oscillation of the mass shown. At Point A the acceleration is



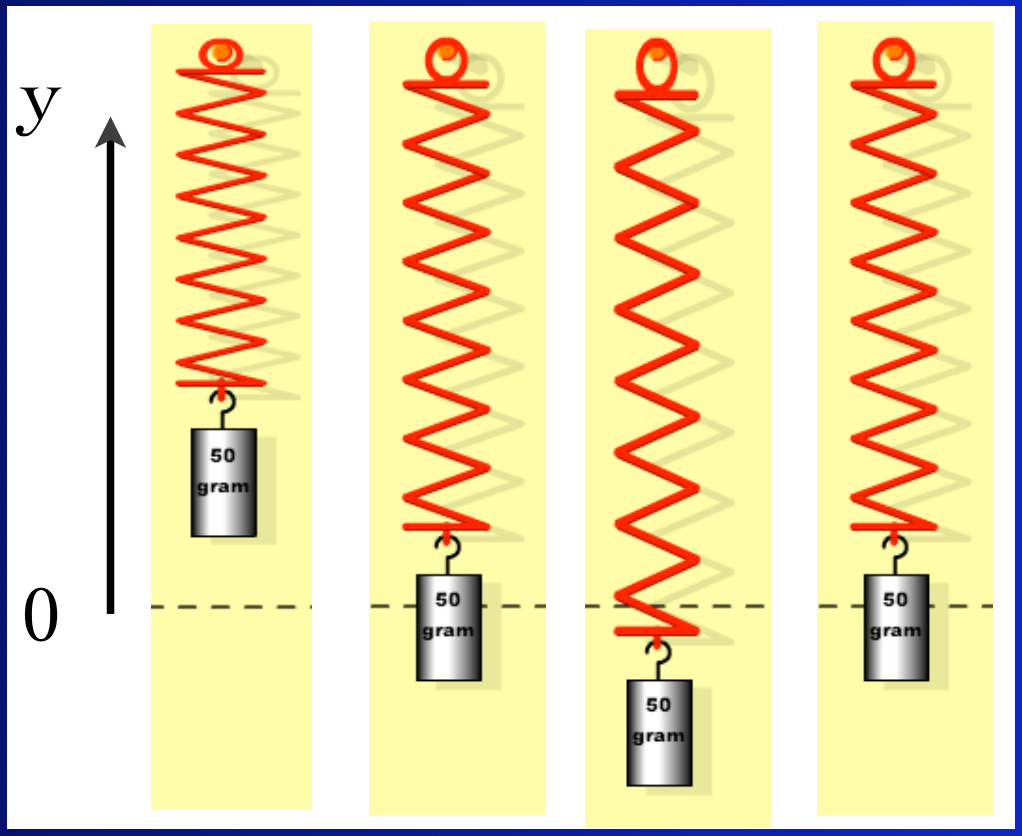
A. positive

B. negative

C. zero

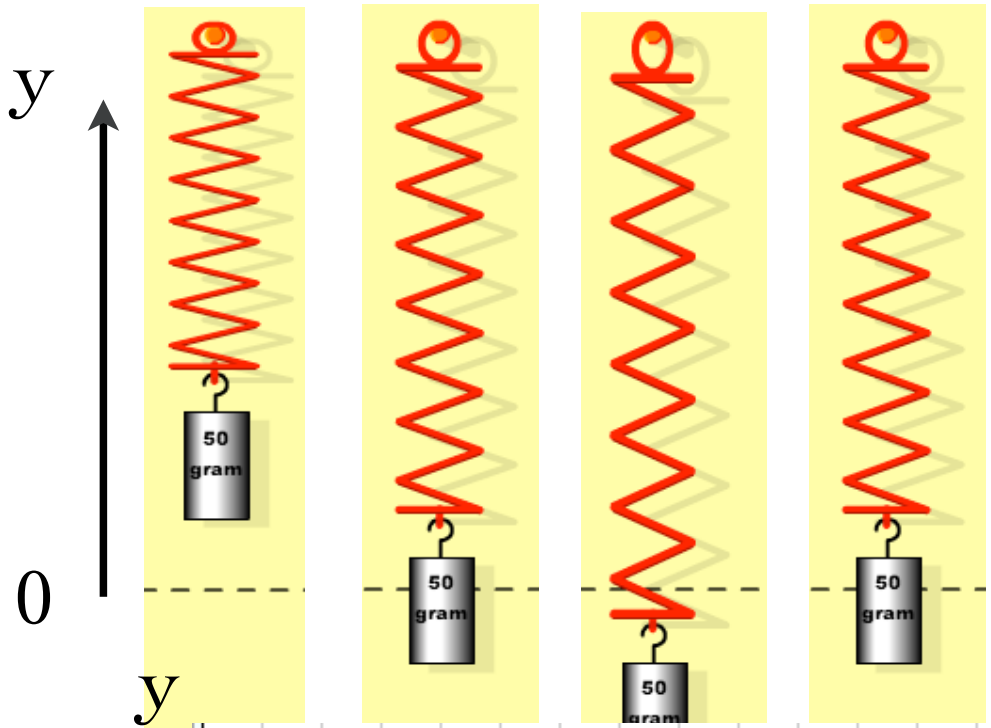
D. huh?

Mass on a Spring: vel. & accel.



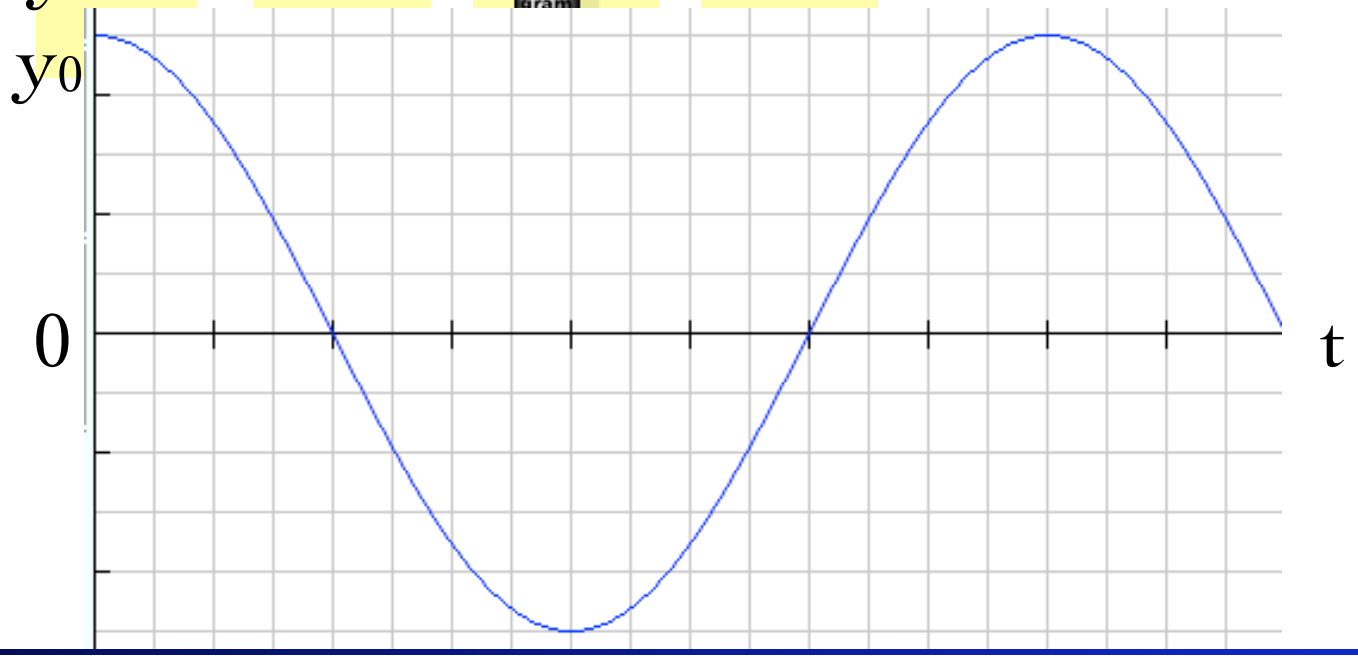
v:	0	–	0	+
a:	–	0	+	0

Mass's Position as a Function of Time



USE RADIANS!!

$$y = y_0 \cos(\omega t)$$



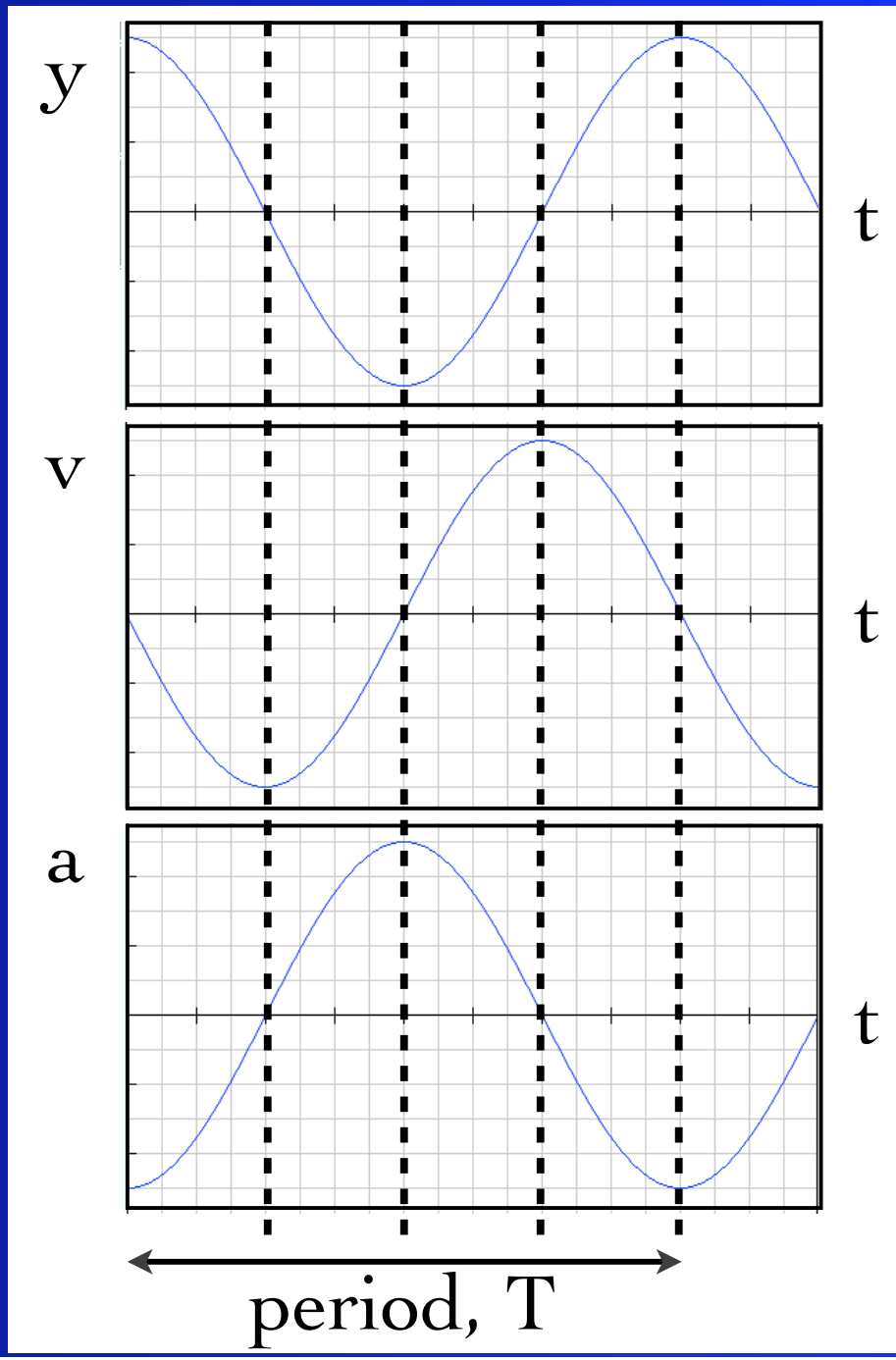
position ⇒ infer velocity & accel.

$y = y_0 \cos(\omega t)$

$v_y = -y_0 \omega \sin(\omega t)$

$a_y = -y_0 \omega^2 \cos(\omega t)$

once we have position as a function of time, velocity and acceleration are determined using derivatives



Period of Oscillation

If we increase the amplitude (A or y_0)—that is, increase the initial displacement—then the period of oscillation:

A. increases

B. decreases

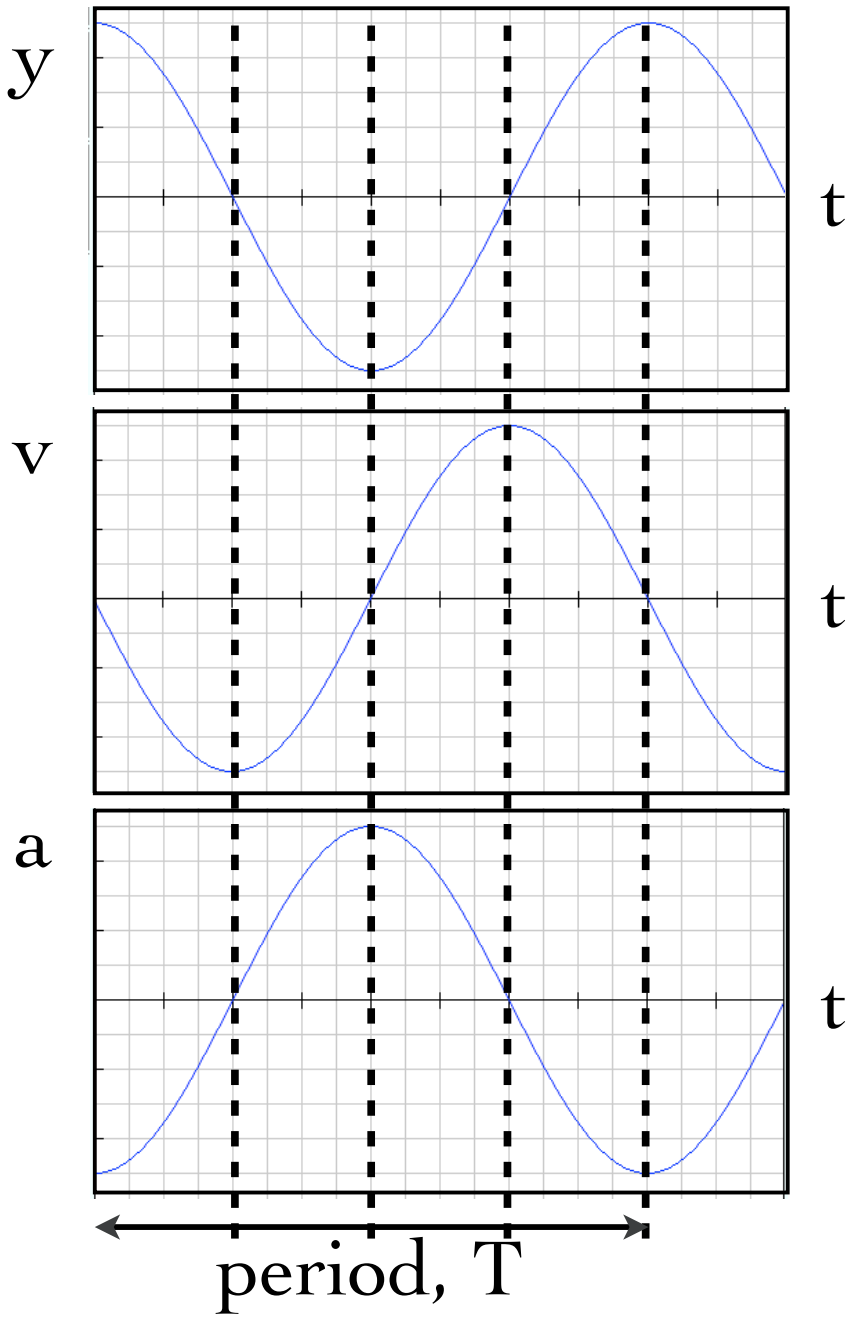
C. remains the same

Period of Oscillation

If we halve the mass, the period of oscillation:

A. decreases by a factor of two
B. decreases by a factor less than two
C. remains constant
D. increases by a factor less than two
E. increases by a factor of two

Review: position, velocity, acceleration



USE RADIANS!!

$$y = y_0 \cos(\omega t)$$
$$v_y = -y_0 \omega \sin(\omega t)$$
$$a_y = -y_0 \omega^2 \cos(\omega t)$$

ω: angular frequency
radians per second

$$\omega T = 2\pi$$

$$\omega = \frac{2\pi}{T}$$

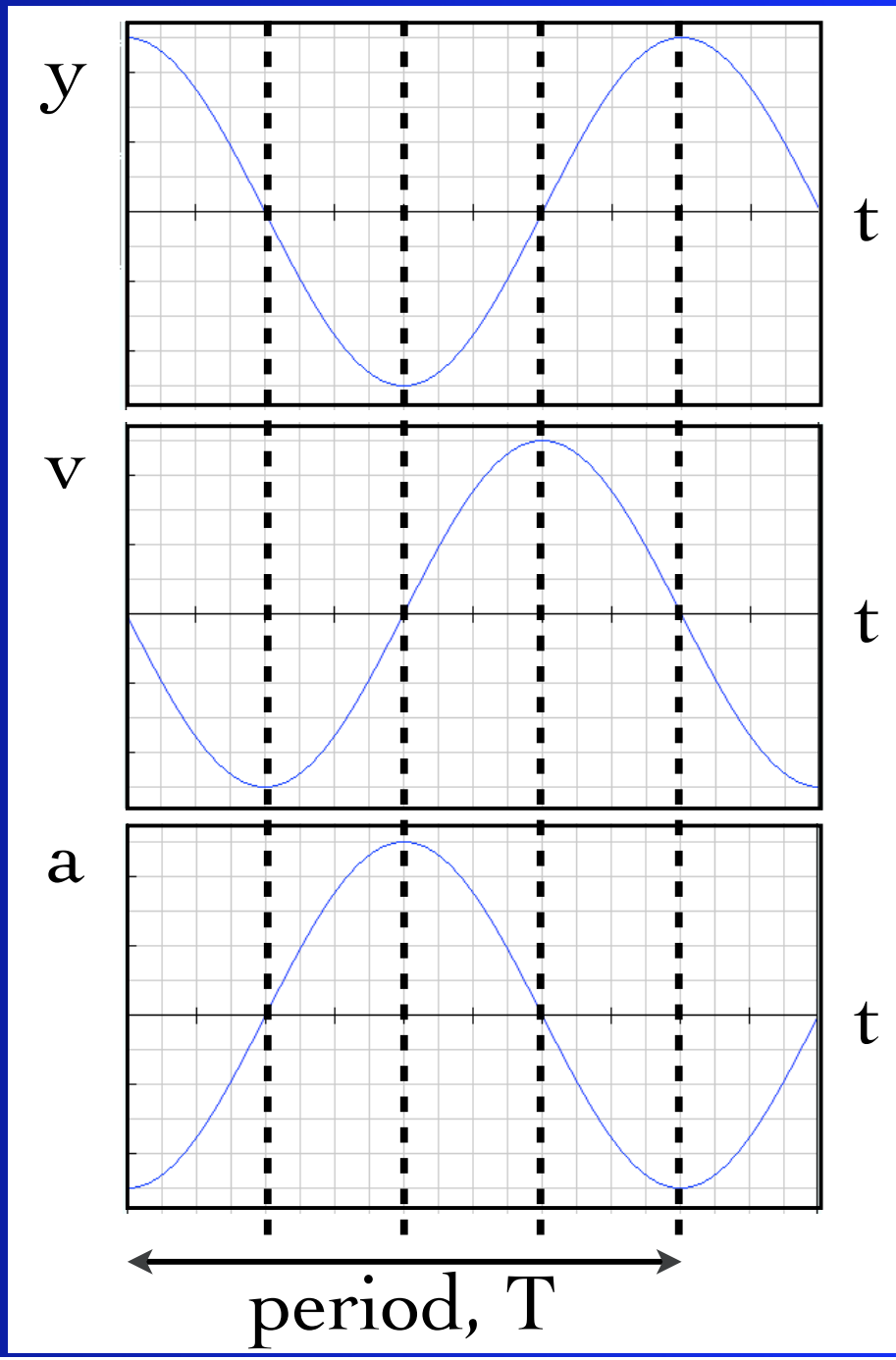
Review: position, velocity, acceleration

$y = y_0 \cos(\omega t)$

$v_y = -y_0 \omega \sin(\omega t)$

$a_y = -y_0 \omega^2 \cos(\omega t)$

and $\omega = 2\pi f$, $\omega = 2\pi / T$, $\omega = \sqrt{(k/m)}$



demo: mass on spring

https://phet.colorado.edu/sims/mass-spring-lab/mass-spring-lab_en.html

(Credit: U. of Colorado, Physics Education Technology)

For Tuesday:

1. get course information from `ted.ucsd.edu` or `cass.ucsd.edu/~rskibba/`
2. self-enroll on `www.webassign.net` using our class key (ucsd 1146 4985)
3. work on the chapter 12 homework problems
4. read through at least sections 1-4 of chapter 12